VOL. V. JANUARY, 1932. NO. 1,

Journal

OF THE

Kansas Entomological Society

PUBLICATION COMMITTEE

PAUL B. LAWSON, Editor, Lawrence
ROGER C. SMITH, Manhattan R. H. PAINTER, Manhattan
W. KNAUS, McPherson DWIGHT ISLEY, Fayetteville, Ark.

DR. FRANCIS HUNTINGTON SNOW
1840—1908

Entered as second-class matter December 31, 1927 at the Post-Office at McPherson, Kansas, under the Act of August 24, 1912.

Kansas Entomological Society

Vol. V, No. 1. January, 1932.

INSECT ENEMIES OF THE CORN EARWORM*
(Heliothis obsoleta Fabr.)

By

T. F. WINBURN and REGINALD H. PAINTER**
Kansas Agricultural Experiment Station

INTRODUCTION

Because of the continued failure to discover a satisfactory control measure for the corn earworm, considerable attention was devoted during 1930 to the insect enemies which attack it. This work was carried on at the field insectary in Manhattan, Kansas.

Review of Literature

A survey of the literature yielded eighty-two different insect enemies of **Heliothis obsoleta** (Fabr.) that have been reported from different parts of the world. This list arranged by families and orders according to Comstock, is given in Table I. Information as to synonyms, stage of host attacked, locality from which recorded as parasitic, and literature references, are given. Where two of the latter are cited, the second is for taxonomic purposes only.

For the taxonomy of the remaining insects, the well known publications by Della Torre (1892-8), Van Duzee (1917), Leng (1920), Britton (1916 and 1923), Blatchley (1910), and Leonard (1928) were used. Where no definite statement was made in the literature, it was assumed that the insect is a parasite of the larva.

---

*Contribution No. 390 from the Department of Entomology.

**The writers wish to express their appreciation of the advice and help given by Professor H. R. Bryson and Dr. R. C. Smith. They are also indebted to Dr. W. T. Forbes, Mr. A. B. Gahan, Mr. R. A. Cushman, and Mr. H. S. Barber for identification of the insects and to Mr. N. A. Cobb for the names of Nemas.

Table I. Insect Enemies of the Corn Earworm

Name	Synonyms	Stage of Host Attacked	Locality Reported From	Literature
	NEUROPTERA			
	Chrysopidae			
*Chrysopa oculata Say	C. chlorophana Bks.	E. L	Commonly	Garman and Jewett (1914)
	C. albicornis Fitch	E. L	reported	
**Chrysopa plorabunda Fitch		E. L		
	HEMIPTERA			
	Miridae			
Cyrtopeltis varians Dist.		E. L	Fla., Tex.	Rosewall and Smith (1930)
	Anthocoridae			
*Orius insidiosus (Say)	Triphleps insidiousus Fieber	E. L	Commonly	Phillips and King (1923)
	Reduvius insidiosus Say		reported	Marshall (1930)
Triphleps australis China		E	Austral.	China (1926)
	Nabidae			
*Nabis ferus L.	Coriscus ferus Stal.	L	Commonly reported	Garman and Jewett (1914)
	Lygaeidae			
Geocoris punctipes Say	G. luniger Fieber	L	Southern	Mally (1893)
	G. pictipes Montandon		States	
	Coreidae			
Acanthocephala femorata Fabr.	A. nasulus Say	L	So. State	Riley (1885)
	A. bispinus Westw.			
	A. obscurus Westw.			
	Pentatomidae			
Glypsus conspicuus Westw.		L	Africa	Haines (1926)
Podisus spinosus Dalt.		L	Commonly reported	Riley (1885)
	COLEOPTERA			
	Carabidae			
Calosoma sycophanta L.		L	Africa	Berlese (1916)

Table I. Insect Enemies of the Corn Earworm (Con'd.)

Table I. Insect Enemies of the Corn Earworm (Con'd.)

Name	Synonyms	Stage of Host Attacked	Locality Reported From	Literature
	Cantharidae			
*Chauliognathus marginatus Fabr.	C. hentzi Lec.	L	Commonly reported	Phillips and King (1923)
Chauliognathus pennsylvanicus DeG	C. americanus Forst. C. bimaculatus Fabr.	L	Commonly reported	Phillips and King (1923)
	Coccinellidae			
*Ceratomegilla fuscilabris Muls.	Megilla maculata auct. not DeG. Megilla strenua Casy	L, E	Commonly reported	Phillips and King (1923)
*Hippodamia convergens Guer.		E, L	Commonly reported	Phillips and King (1923)
	DIPTERA **Asilidae**			
Deromyia angustipennis (Loew.)	Diogmites augustipennis Loew.	A	Texas	Quaintance and Brues (1905)
Erax interruptus Macq.	E. maculatus Macq. E. lateralis Macq. E. ambiguus Macq. E. villosus Bellardi	A	Southern States	Mally (1893) Hine (1919)
	Phoridae			
Aphiochaeta nigriceps Loew.	Phora aletiae Comstock	L	Southern States	Mally (1893); Brues (1906)
	Sarcophagidae			
Sarcophaga latisterna Park.		L	Va.	Phillips and King (1923)
	Tachinidae			
Acheatonema aletiae Riley	Tachina fraterna Comstock T. aletiae Riley Frontina aletiae Riley	L	Miss.	Allen (1926); Webber (1930)

(Continued on Next Page)

Table I. Insect Enemies of the Corn Earworm (Con'd.)

Name	Synonyms	Stage of Host Attacked	Locality Reported From	Literature
	Tachinidae (Cont'd.)			
Archytas pilliventris v. d. Wulp		L	Southern States	Quaintance and Brues (1905)
Euphorocera claripennis Macq.		L	Southern States	Quaintance and Brues (1905)
Exorista ceratomiae Coq.		L	Southern States	Quaintance and Brues (1905)
Exorista pyste Walker		L	Virgin Islands	Wilson (1923)
Achaetoneura archippivora (Will.)	**Tachina archippivora** Riley **Masicera archippivora** Will. **Meigenia websteri** Towns. **Phorocera promiscus** Towns. **Ypophaemyia malacosomae** Town **Parafrontina apicalis** B. & B. **Masicera panciseta** (Coq.) **Masiceropis panciseta** Towns.	P	Hawaii	Fullaway (1914); Webber (1930)
Lydella armigera (Coq.)	**Tachina (Masicera) armigera** Coq **Frontina armigera** Coq.	L	Commonly reported	Quaintance and Brues (1905) Webber (1930)
Achaetoneura frenchii (Will.)	**Achaetoneura hesperus** B. & B. **Phorocera promiscua** Towns. **Mugenia websteri** Towns. **Tachina anonyma** Riley **Masicera frenchii** Will. **Masicera datanarum** Towns. **Frontina malacosomae** Curran **Frontina sordida** Curran	L	Commonly reported	Quaintance and Brues (1905) Webber (1930)

(Continued on Next Page)

Table I. Insect Enemies of the Corn Earworm (Con'd.)

VOL. V. JOURNAL KANSAS ENT. SOC. JANUARY, 1932. NO. 1.

(Continued on Next Page)

Table I. Insect Enemies of the Corn Earworm (Con'd.)

Name	Synonyms	Stage of Host Attacked	Locality Reported From	Literature
	Tachinidae (Cont'd.)			
Achaetoneura frenchii (Will.) con't.	**Frontina frenchii** Will.			
Gonia capitata DeG.		L	Southern States	Quaintance and Brues (1905)
Linnaemyia longirostris Macq.		L	South Africa	Entomological Notes (1928)
Paratachina ingens B. & B.		L	South Africa	Entomological Notes (1928)
Phorocera blepharida B. & B.		L	South Africa	Entomological Notes (1928)
Spallanzania bucephala Meig.	**Cnephalia bucephala** Meig.	L	Russia	Rodinov (1927)
Sturmia laxa Curran		L	Africa	Curran (1927)
***Tachina rustica** Fall.		L	Russia	Rodinov (1927)
***Winthemia quadripustulata** Fabr.		L, P	Commonly reported	Allen (1925)
Zenillia illita Villen.		L	Africa	Curran (1927)
	Muscidae			
Muscina stabulans (Fall.)	**M. cinerascens** Wiedemann **Cyrtoneura stabulans** (Riley)	P	Russia	Rodinov (1927)
	HYMENOPTERA			
	Braconidae			
Apanteles sp.		L	Fiji	Simmonds (1926)
Apanteles flavipes Cam.	**A. nonogriae** Alliff.	L	England	Wilkinson (1929)
Apanteles marginiventris Cress.	**A. grenadensis** Ashm. **A. (Protapanteles) hardedi** Vier **A. laphygmae** Ashm. **A. militaris** Walsh.	L	Commonly reported	Vickery (1929) Muesebeck (1920)
Apanteles papilionis Vier.	**A. augamemononis** Wilkn.	L	England	Wilkinson (1929)

(Continued on Next Page)

Table I. Insect Enemies of the Corn Earworm (Con'd.)

Name	Synonyms	Stage of Host Attacked	Locality Reported From	Literature
	Braconidae (Cont'd)			
Apanteles rufierus Hal.	**A. antipoda** Ashm.	L	England	Wilkinson (1929)
Bracon kitcheneri D. & G.		L	India	Husain (1924)
Chelonus sp.		L	India	Chopia (1928)
Chelonus texanus Cress.		L	Texas	Luginbill (1928)
Habrobracon plotnikovii Bogoljubov		L	Turkestan	Bogoljubov (1914)
Habrobracon simonovi Taschkent		L	Turkestan	Kokujev (1914)
Meteorus laphygmae Vier.		L	Texas	Luginbill (1928)
Microbracon simonovi Kok.		L	Russia	Rodinov (1927)
***Microplitis croceipes** (Cress.)	**Microgaster croceipes** Cress.	L	Southern States	Quaintance and Brues (1905)
****Microplitis** sp., near **melianae** Vier.	**Microplites nigripennis** Ashm.			
	Ichneumonidae			
Amblyteles crespatorius L.		L	Russia	Rodinov (1927)
Atractodes sp.		L	India	Chopia (1928)
Barylypa humeralis Brauns		L	Russia	Rodinov (1927)
Henicospilus concolor Cress.		L	Virgin Is.	Wilson (1923)
Paniscus geminatus Say		L	Va.	Phillips and King (1923)
Paniscus geminatus var. **sayi** Cush.		L	Miss.	Vance (1927)
Paniscus spinipes Cush.		L	Miss.	Vance (1927)
***Sagaritis provancheri** Dal. Torre	**S. dubitatis** Cress.	L	Commonly reported	Vickery (1929);
	Proctotrupoidea			
Neatelenomus sp.		E	Australia	Veitch (1927)
***Telenomus heliothidis** Ashm.		E	Commonly reported	Quaintance and Brues (1905)

(Continued on Next Page)

Table I. Insect Enemies of the Corn Earworm (Con'd.)

Table I. Insect Enemies of the Corn Earworm (Con'd.)

Name	Synonyms	Stage of Host Attacked	Locality Reported From	Literature
	Chalcidoidea			
Chalcis annulata Fabr.		L	Virgin Is.	Wilson (1923)
Chalcis ovata Say		L	Southern States	Mally (1893)
Chalcis robusta Cress.		L	Virgin Is.	Wilson (1923)
Euplectrus comstocki How.		L	Southern States	Luginbill (1928)
***Euplectrus platyhypennae** How.		L	Southern States	Luginbill (1928)
Spilochalcis femorata Fabr.		L	Virgin Is.	Wilson (1923)
Spilochalcis vittata Ashm.		L	Virgin Is.	Wilson (1923)
Trichogramma australicum Gir.		E	Australia	Veitch (1927)
***Trichogramma minutum** Riley		E	Commonly reported	Phillips and King (1923)
Trichogramma pretiosa Riley		E	Commonly reported	Quaintance and Brues (1905)
Trichogramma rarum Gir.		E	Australia	Veitch (1927)
	Formicioidea			
Dorymyrmex pyramicus Roger		L	Southern States	Mally (1893)
Lasius niger americanus Emery		L	Ill.	Flint (1914)
Monomorium carbonarium Smith		E, L	Southern States	Quaintance and Brues (1905)
Solenopsis geminata Fabr.		E, L	Commonly reported	Quaintance and Brues (1905)
Solenopsis molesta Say		E, L	Commonly reported	McColloch and Hayes (1916)
Solenopsis texana Emery		L	Texas	Quaintance and Brues (1905)

(Continued on Next Page)

Table I. Insect Enemies of the Corn Earworm (Con'd.)

Name	Synonyms	Stage of Host Attacked	Locality Reported From	Literature
	Vespoidea			
Eumenes bolli Cress		L	Texas	Quaintance and Brues (1905)
Eumenes maxillonsus DeG.		L	So. Africa	Munro (1926)
Polistes annularis Linn.		L	Commonly reported	Quaintance and Brues (1905)
Polistes rubiginosus Lepel.		L	Commonly reported	Quaintance and Brues (1905)
Polistes schach Fabr.		L	Australia	Currie (1928)
Polistes texanus Cress.		L	Texas	Quaintance and Brues (1905)

* Collected on corn or reared at Manhattan in connection with this study.

** Reported for first time as attacking corn earworm.

*** See Aldrich "Catalogue of North America Diptera", page 471, for 14 synonyms reported from Annales Soc. Ent. France.

Abreviations are as follows: E—egg, L—larva, P—pupa, A—adult.

In the literature five orders are represented as containing enemies of the corn earworm, including 46 species of Hymenoptera, 22 of Diptera, eight of Hemiptera, five of Coleoptera, and one of Neuroptera. To this list one species of Neuroptera and one of Hymenoptera can be added from the work at Manhattan during 1930.

Under the heading "Locality Reported From" the entry made is "Commonly Reported", if two or more references are at hand reporting that particular insect as parasitic. Otherwise, the locality from which it was reported is given.

A number of the insect enemies have been reported from the "Southern States". Virtually all of these were reared from **H. obsoleta** larvae that were feeding on cotton. In fact, most of the parasites have been reported from southern parts or southern countries. This either means that more work was done there or that the conditions are better for the parasites. The latter is more likely the case.

South America and Central America are supposed to be the original home of the corn plant. If corn is the primary host of **H. obsoleta,** as is generally thought, we would expect to find the more specialized parasites in that area. However, the literature contained no references to parasites from those localities. This is undoubtedly due to lack of information which should be supplied before our knowledge of the insect enemies of the corn earworm is complete. On the other hand, other members of the genus **Heliothis** and their parasites reported from Russia (Shchegolev, 1929) would indicate that region as perhaps the original home of the wide spread **Heliothis obsoleta.**

Of the nine American Tachinids reported there are only two that may perhaps be obligate parasites on **H. obsoleta.** The rest are parasitic on a large number of insects.

The same applies to the Hymenoptera to a certain extent. **Trichogramma minutum and Sagartis pravencheri** are common examples of those that have many hosts.

While **H. obsoleta** has a large number of insect enemies the majority of them are only of passing interest because of this lack of specialization. There are several however that do some good.

Jarvis (1924) (Queensland, Agric. Jl.) in speaking of the corn earworm states, "Fortunately, this pest is kept in check in this district by several parasites, both Dipterous and Hymenopterous ones". He mentioned a Braconid, a Bombyliid, and a Tachinid. This is the only reference to a Bombyliid as a parasite of the corn earworm found in the literature, and the species name of it as well as of the others was not given.

A very interesting parasite is cited by Bogoljubov (1913) of the Turkestan Station. The name is not given but the following description is supplied; "the females kill the caterpillars with their ovipositor, feeding on their blood and depositing eggs on the killed insect. The parasites prefer the blood of fresh victims and pass from one caterpillar to another. In the laboratory some females have killed as many as eight caterpillars during their life and deposited on them about 100 eggs. The development of the parasite from egg to imago requires from eight to fifteen days, thus a large number of generations are bred during one summer".

This parasite might prove to be a very valuable one as a long ovipositor is needed to reach most of the larvae when they are in the corn ear. The protection offered by the shucks is probably the reason why there is very little parasitism of the larvae found on corn.

METHODS AND MATERIALS

Work of the collection of the parasites of **H. obsoleta** was started in May, 1930, as soon as the corn had sprouted. All the Lepidoptera, whether corn earworm or not that were found attacking the corn plant, were taken to the Entomology Field Insectary for rearing. By the middle of June **H. obsoleta** had become so numerous that all collected could not be handled and then only a representative number of about 25 was taken from each field in which collections were made.

All the collections were made from fields within a

radius of five miles of Manhattan until the last of the season when larvae were obtained from Harper, Ellsworth, and Lincoln Counties.

The larvae were reared on tender corn leaves in jelly glasses. Dirt was furnished in the bottom for pupation. One ounce salve boxes were used for some of the collections but were found to be much less satisfactory. Egg parasites were reared in small shell vials. During this period all possible Lepidopterous larvae were collected on corn and any parasites which emerged were tested for possible oviposition on corn earworm. An attempt was made to keep a stock of each parasite by reinfesting the appropriate stage. Earworm larvae were collected on corn, alfalfa and sorghums.

DISCUSSION AND RESULTS

The collecting done in the vicinity of Manhattan was seriously hampered by the unusual heat and drought during July and the first half of August. Larvae were extremely scarce and eggs frequently were not to be found.

Egg Parasitism

The first part of Table II gives the total amount of parasitism and the species involved; the second compares the species as to percentage, and the third compares them from the point of number of collections made.

Telenomus heliothidis (Ash.)

These insects mated readily and immediately began ovipositing on the eggs furnished them in the shell vials.

In studying **T. heliothidis** it was noted that the female had a characteristic method of approaching the egg. The egg is explored with fast movements of the antennae until a suitable spot is found. Then the antennae are folded in front of the head, the prothoracic legs are also folded, the mesothoracic legs are extended at length to push the anterior end of the insect as far as possible from the egg. Next the metathoracic legs are folded on the egg thus leaving the insect at an angle of almost 90 degrees from the egg. The wings are then slightly spread and extended over the side of the egg and the ovipositor is inserted. Time for oviposition by

Table II. Parasitism of Corn Earworm Eggs at Manhattan

Date	Place	Eggs Collected	Number Parasitized	Kind of Parasite	Per cent
6-16-30	Collin's Farm	38	12	**Telenomus heliothidis** Ashm.	30.52
6-18-30	Hunter's Island	70	0	None	0
6-20-30	Hunter's Island	130	6	**Trichogramma minutum** Riley	4.62
			56	**Telenomus heliothidis** Ashm.	43.07
8-20-30	Pottawatomie County (Two miles east of bridge)	13	0	None	0
8-25-30	Insectary	50	0	None	0
8-25-30	Agronomy Farm (West of Sewell's plots)	110	1	**Telenomus heliothidis** Ashm.	0.9
8-25-30	Agronomy Farm (Field south of alfalfa plots)	80	5	**Telenomus heliothidis** Ashm.	6.25
8-25-30	Moehlman Bottoms	20	0	None	0
8-26-30	Hunter's Island (One mile south Collin's farm)	75	8	**Telenomus heliothidis** Ashm.	10.67
8-26-30	Hunter's Island (Field west of Collin's farm)	60	4	**Telenomus heliothidis** Ashm.	6.67
8-27-30	Field Insectary	20	2	**Telenomus heliothidis** Ashm.	10.00
8-27-30	Popcorn patch	75	3	**Telenomus heliothidis** Ashm.	4.
8-28-30	Pottawatomie County	100	2	**Telenomus heliothidis** Ashm.	2.
8-28-30	Jone's Cabin	100	0	None	0
8-28-30	Ashland	70	0	None	0
9-2 -30	Field Insectary	95	0	None	0
9-17-30	Ashland	110	41	**Trichogramma minutum** Riley	37.27
9-19-30	Ogden	84	3	**Telenomus heliothidis** Ashm.	3.57
			60	**Trichogramma minutum** Riley	71.43
9-19-30	S. E. Junction City	24	6	**Telenomus heliothidis** Ashm.	25.
9-22-30	S. E. Junction City	217	15	**Trichogramma minutum** Riley	6.91
10-10-30	Hunter's Island	128	11	**Trichogramma minutum** Riley	8.59
			5	**Telenomus heliothidis** Ashm.	3.90
	Total	1669	240		14.38

Table II Concluded

Species Compared

Total Number of Eggs Collected	Number of Eggs Parasitized	Parasite	Per cent
1669	133	**Trichogramma minutum** Riley	8.
1669	107	**Telenomus heliothidis** Ashm.	6.4

Parasitism of Twenty-one Collections **H. obsoleta** Eggs

Number of Collections Parasitized	Parasite	Per cent
12	**Telenomus heliothidis** Ashm.	57.1
5	**Trichogramma minutum** Riley	23.8

Female No. 1.

Oviposition No. 1, two minutes, 30 seconds
Oviposition No. 2, one minute, 20 seconds same egg
Oviposition No. 3, two minutes, 15 seconds same egg
Oviposition No. 4, two minutes, 50 seconds

Female No. 2.

Oviposition No. 1, one minute, 35 seconds
Oviposition No. 2, one minute, 30 seconds

After the ovipositor is withdrawn it is stroked violently in all directions on the host shell evidently cleaning it on the ridges of the egg. Also, the females often stroke their wings with their legs after the ovipositor has been cleaned.

In no case did more than one parasite emerge from **H. obsoleta** egg. The **T. heliothidis** larvae fed entirely within the earworm eggs, pupated and emerged from the host eggs as mature adults. The time required for development varied from 12 to 32 days. The conditions of moisture and temperature in each vial approached similarity too closely to explain this variation on such a basis.

It was observed that the mated individuals did not live as long as the isolated males and females under conditions that were otherwise similar. The insects would feed ravenously on syrup placed on the cork of the vial in which they were confined. Unmated individuals averaged about 21 days but the record for length of life was 40 days for one individual.

In dealing with the mated individuals it was found that the males died soon after mating and the females shortly after oviposition. On an average the latter lived from three to five days, with an occasional one living for ten days.

In some earlier work at the Experiment Station at Manhattan, Dr. W. P. Hayes found evidence that this insect may survive over winter in the egg of **H. obsoleta** if November 8 can be considered late enough for the beginning of hibernation.

two **T. heliothidis** was observed with the following results in the respective cases.

Trichogramma minutum Riley

As noted above **T. minutum** was found in several collections of earworm eggs. Upon emergence the adults were placed in the vial cages and mating occurred immediately. The females acted in a manner similar to Telenomus whenever any **H. obsoleta** eggs were found. They crawled over the eggs tapping them with their antennae until a suitable spot was found. Then the thin ovipositor was inserted and the eggs deposited. This process required about two minutes for each egg. As soon as the ovipositor was withdrawn the parasite was ready to lay another egg. The position taken in oviposition was similar to the one assumed by **Telenomus.**

On the third day after being parasitized the **H. obsoleta** eggs rapidly became darker and finally turned to a bluish black color. This coloration persisted even after the parasites had emerged and always served to distinguish a parasitized egg.

The developmental period from time of oviposition to emergence from the host egg varied from eight to ten days. The number of parasites emerging from each egg varied from one to four with an average of 2.5. This was determined by placing 50% of the parasitized eggs separately in small shell vials.

The adults seemed to feed but very little if any on the syrup offerd them on the cork to their vial. Their average length of life was about one and one-half days but this sometimes reached a maximum of four.

Parasitism of Larvae

In all, 786 Lepidopterous larvae were collected near Manhattan, of these 614 were **H. obsoleta,** 550 secured from corn and 74 from alfalfa. These were recorded in Table III. On one occasion rats destroyed several of the specimens as recorded under the heading "Destroyed by Rats." These insects were virtually all pupae. The rest of the pupae not accounted for in the table survived over winter in that stage.

Table III. Corn Earworm L[arvae] o[n]

Place	Number larvae collected	Pupated		Emerged		Parasitized		M
		No.	Per cent	No.	Per cent	No.	Per cent	No.
Hunter's Island	120	26	21.7	21	17.5	1		1
Agronomy Farm	41	19	46.4	14	34.2	0	0	0
Pottawatomie County	83	49	59.1	32	38.6	1	1	0
Field Insectary	53	17	32.1	11	20.8	0	0	0
Ashland	35	16	45.7	10	28.6	0	0	0
Prof. Dicken's Farm	23	20	87	15	63.3	0	0	0
Moehlman Bottoms	68	53	78	39	51.4	0	0	0
Manhattan Hatchery	56	6	10.7	2	3.6	0	0	5
Wabaunsee County	10	3	30	3	30	0	0	0
Miscellaneous	61	12	19.7	9	14.8	0	0	2
TOTAL	550	221	40.2	156	28.3	2	.9	8

Corn Earworm Larva[e] on A[ir]

Agronomy Farm	41	16	39	7	17.1	2	4.9	0
Pottawatomie County	10	7	70	3	30	0	0	0
Field Insectary	12	5	41.6	3	25	0	0	0
Miscellaneous	11	2	18.4	0	0	0	0	0
TOTAL	74	30	40.6	13	17.6	2	2.7	0

...orm L...ed on Corn at Manhattan

Parasi-ized		Died								Destroyed by Rats	
		Mites		Nema-todes		All Other Causes		As Pupa			
No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
1	.5	1	.8	2	1.7	91	75.8	3	2.5	2	1.7
0	0	0	0	0	0	22	52.6	0	0	3	7.3
1	1.2	0	0	4	4.8	33	39.8	5	6	6	7.2
0	0	0	0	0	0	36	68	2	37.7	0	0
0	0	0	0	2	5.7	19	54.3	3	8.6	1	2.8
0	0	0	0	5	21.7	3	13.1	2	8.7	0	0
0	0	0	0	8	11.7	15	22.1	3	4.4	3	4.4
0	0	5	8.9	0	0	49	87.5	4	7.2	0	0
0	0	0	0	0	0	7	70	0	0		
0	0	2	3.3	0	0	41	67.3	1	1.6	9	14.8
.3	.3	8	1.4	21	3.8	316	57.4	23	4.2	24	4.3

...Larva... on Alfalfa at Manhattan

4.9	0	0	0	0	1	2.4	22	53.6	2	4.9	7	17.1
0	0	0	0	0	0	6	3	30	0	0	2	20
0	0	0	0	0	0	0	4	33.3	0	0	3	25
0	0	0	0	0	1	9.1	5	45.5	0	0	5	45.5
2.7	0	0	0	0	2	2.7	34	46	2	2.7	17	23

The table shows the insect parasitism as very small, especially on larvae on corn. This is probably due to the protection offered by the shucks. Four larvae with Tachinid eggs attached were collected from alfalfa but are not recorded under the parasitized column because the larvae were reared to maturity. This shows that the eggs were evidently cast off with the molted skins.

Mites and nemas killed a number of larvae. It was not determined whether or not these enemies came from the soil in the jelly glasses but new larvae added to these containers were always killed.

A specimen infested with these nemas was sent to Dr. N. A. Cobb who determined them as **Diplogaster aerivora** Cobb. It was observed that it took these worms an average of eight days to kill a **H. obsoleta** larvae. Another seven days passed before they ate their way out through the body wall where they could be seen.

The writers are indebted to Mr. Dwight Patton of Harper county for sending some earworm larvae collected on alfalfa. These were heavily parasitized as shown in Table IV.

The fungus reported as killing some of the larvae was very characteristic in its action and the symptoms were always the same. Upon death the larvae were very firm and seemed to be stretched lengthwise to their utmost extent. Then on the second day a white fungus growth appeared all over their bodies.

The larvae taken on October 7 from Ellsworth and Lincoln Counties were more heavily parasitized when compared to those taken earlier in the year from corn and alfalfa. These results are given in Tables V, VI, and VII.

Microplitis croceipes (Cress.)

M. croceipes was very numerous among the larvae collected from Harper, Ellsworth, and Lincoln Counties. A total of 176 larvae out of 318 were parasitized; this is 55.3 per cent.

Table IV. Corn Earworm Larvae Collected on Alfalfa in Harper County, Sept. 1930.

			Parasitized				Died			
	Pupa		Microplitis croceipes		Winthema 4-pustulata		Fungus		All other causes	
Total	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
70	3	4.3	37	25.9	1	1.4	6	8.6	23	32.9

Table V. Corn Earworm Larvae Collected on Kafir in Lincoln County, Oct. 7, 1930.

			Parasitized		Died	
	Pupa		Microplitis croceipes		All other causes	
Total	No.	Per Cent	No.	Per Cent	No.	Per cent
30	5	16.7	21	13.3	4	13.3

Table VI. Corn Earworm Larvae Collected on Alfalfa in Lincoln County, Oct. 7. 1930.

	Parasitized					
	Microplitis croceipes		Microplitis sp., near melianae		Died	
					All other causes	
Total	No.	Per Cent	No.	Per Cent	No.	Per cent
72	39	54.2	3	4.2	30	41.7

Table VII. Corn Earworm Larvae Collected on Alfalfa in Ellsworth County, Oct. 7, 1930.

			Parasitized				Died			
	Pupa		Microplitis croceipes		Microplitis sp., near melianae		Fungus		All other causes	
Total	No.	Per cent	No.	Per cent	No.	Per cent	No.	per cent	No.	per cent
216	2	.9	116	53.7	11	5.1	18	8.3	69	31.9

Table VIII gives a total parasitism of the **H. obsoleta** larvae taken from all places on the different hosts.

Table VIII. Total Parasitism of H. obsoleta Larvae.

		Parasitized		Died			
				Fungus		All other causes	
Collected on	Total collected	No.	Per cent	No.	Per cent	No.	Per cent
Corn	550	2	0.4	2	.4	316	57.5
Alfalfa	432	209	48.4	24	5.6	156	36.1
Kafir	30	21	70.0	0	0	4	13.3
Total	1012	232	22.9	26	2.6	476	47.1

The action of a parasitized corn earworm was characteristic. By the time the parasite grub is full grown the larvae has shrunk to about one inch in length, has acquired a pale yellowish color and has stopped feeding. Within the next half day the parasite emerges leaving a small black scar. The earworm larvae lives for several days but does not feed any more and gradually dries up. Upon emergence the parasite grub spins an oval cocoon about 5 or 6 mm. in length and having several coarse longitudinal ribs. At first the cocoon is almost white but soon turns to a dingy yellow and gets very tough. The adult parasite emerges by cutting a cap off the end of the cocoon. Late in the fall 3 of the 176 emerged and the rest remained in their cocoons over the winter.

The following description of this insect is given by Quaintance and Brues (1905) under the name of **M. nigripennis** which is a synonym of **M. croceipes.**

"Length, 4 to 5 mm. Black, except the abdomen and legs, which are usually reddish yellow. Wings very strongly infuscated. Antennae 17 jointed. Head and thorax shining black, methathorax coarsely reticulated, with median carina. Abdominal petiole black at base and remainder of abdomen sometimes much darkened. Legs reddish, the coxae more or less black at base. Wings very dark, veins blackish, second cubital cell about as high as long, subtriangular."

Miscellaneous Enemies of the Earworm

Orius insidiosus (Say.)

Among the predators **Orius insidiosus** is probably the most beneficial. This is a vicious little insect as evidenced by one of the writers who on several different occasions was bitten by the adults.

A detailed life history is given by Marshall (1930) in his paper. Since he did his work at this station it need not be repeated.

These insects, both adults and nymphs, were very numerous on the corn silks and corn ears. It was assumed that a large number of the empty **H. obsoleta**

egg shells found on the silks were due to them. Since the eggs were white they had not been parasitized by the egg parasites and had they hatched these egg shells would have been eaten by the young earworm larvae. The predacious habit of **Orius insidiosus** was further proved by the fact that several collections of both nymphs and adults were made and that in both cases they readily attacked **H. obsoleta** eggs and small larvae given them under cage conditions.

Quaintance and Brues (1905) found that 55 per cent of the eggs and many of the small larvae of the corn earworm were destroyed by **O. insidiosus.** When eggs are attacked, the beak is thrust through the shell and the contents extracted. The same thing happens when live insects are captured.

None of the attempts to parasitize **H. obsoleta** with parasites of other Lepidopterous insects of the corn fields made by confining the earworm larvae in cages with those parasites, were successful.

During the fall of 1929 numerous larvae of **Chauliognathus marginatus** (Cantharidae) were collected while in the act of destroying **H. obsoleta** larvae. These were very active and able to kill a large **H. obsoleta** larva. Especially was this true where the beetle larvae followed its prey into a tunnel in a corn ear where the earworm could not be very active due to lack of room. These beetle larvae had the peculiar habit when disturbed of casting off a milky secretion from ducts along the sides of the abdomen. There seemed to be one of these ducts on the side of each segment. They lived over the winter in small runways in the soil of their glass containers without food. The first larva pupated during May and emerged on June 26. Females of **Chauliognathus pennsylvanicus** collected in the field were placed individually in salve boxes about one-half full of dirt and fed syrup. In several cases egg masses of from 150 to 200 eggs, which hatched in about ten days, were secured. Unsuccessful attempts were made to feed these small larvae and on the second day they burrowed into the ground and formed a cell in which they remain-

ed. The hot dry weather during July killed all of them and during the last of August more were secured. They acted in a similar manner and remained over the winter in their cells.

The lady bird beetle larvae collected and reared to maturity on small **H. obsoleta** larvae were **Ceratomegilla fuscilabris** Muls. and **Hippodamia convergens** Muls. These were often observed on the corn plants in the field.

SUMMARY

1. 82 species of insects are reported in the literature as enemies of the corn earworm. These represent five orders, including: 46 species of Hymenoptera, 22 of Diptera, 8 of Hemiptera, 5 of Coleoptera and 1 of Neuroptera.

2. Two new insect enemies of the corn earworm were found at the Kansas Station. These are **Chrysopa plorabunda** Fitch and **Microplitis** sp., near **melianae** Vier.

3. The most important enemies in this section of Kansas are: The egg parasites, **Trichogramma minatum** Riley and **Telenomus heliothides** (Ashm.); the larval parasite, **Microplitis croceipes** (Cress) and the predacious bug **Orius insidiosus** (Say).

4. The parasitism of the earworm on corn is very small. This shows that a parasite is needed which has a long ovipositor or habits which will enable it to reach the **H. obsoleta** larvae in spite of the protecting shucks.

5. A parasite like that reported by Bogoljubov (1913) may be of this type and might prove to be valuable if introduced.

BIBLIOGRAPHY

Aldrich, J. M.

1905. A Catalogue of North American Diptera. Smithsonian Miscellaneous Collections, Vol. 46, 680 pp.

Allen, H. W.

1925. Biology of the Red-Tailed Tachina-Fly, **Winthemia quadripustulata** Fabr. Tech. Bul. Miss. Agric. Expt. Sta., No. 12, 32 pp.

Allen, H. W.

1926. Notes on Some North American Species of **Achaetoneura** with a Description of One New Species (Diptera; Tachinidae). Trans. Amer. Ent. Soc., Vol, 52, pp. 187-198,

Anonymous

1928. Entomological Notes, No. 39. Farming in South Africa, July 1928. Pretoria. Reprint, 2 pp. (Abstract in Rev. Appl. Ent., Vol. 16, p. 648).

Belese, A.

1916. Entomophagus Insects and Their Practical Employment in Agriculture. Internat. Rev. Science and Practic. Agric. (Mo. Bul. Agric. Intell. Plant Dis.), Rome, Vol. 7. pp, 321-332.

Blatchley, W. S.

1910. An Illustrated Descriptive Catalogue of the Coleoptera or Beetles Known to Occur in Indiana. The Nature Publishing Co., Indianapolis, Indiana, 1386 pp.

Bogoljubov, S. N.

1913. Parasites of Chloridae and the Codling Moth. Agriculture of Turkestan, No. 8, pp. 810-813.

Bogoljubov, S. N.

1914. A New Species of Habrobracon sp., Parasitizing Caterpillars of **Chloridae obsoleta**, F.: Its Biology and Its Agricultural Importance. Agriculture of Turkestan, Tashkent, No. 3, pp. 281-291.

Britton, W. E.

1916. Guide to the Insects of Connecticut. Part III. The Hymenoptera, or Wasp-like Insects, of Connecticut. Bul. 22, Connecticut Geological and Natural History Survey. 824 pp., 10 pls., 15 figs.

Britton, W. E.

1923. Guide to the Insects of Connecticut. Part IV. The Hemiptera or Sucking Insects of Connecticut. Bul. 34, Connecticut Geological and Natural History Survey, 807 pp., 20 pls., 169 figs.

Brues, C. T.

1906. Wytsman's Genera Insectorum. Fasc. 44, Diptera: Fam. Phoridae, 21 pp, 2 color pls.

China, W. E.

1926. A New Species of Triphleps (Heteroptera, Anthocoridae) Preying on the eggs of **Heliothis obsoleta**, H. S. in Queensland. Bul. Ent. Res., Vol. 16, pt, 4. pp, 361-362,

Chopia, R. L.

1928. Annual Report of the Entomologist to the Government, Punjab, Lyallpur, for the Year 1925-1926. Rpt. Dept. Agric. Punjab, 1925-1926, pt. 2, Vol. 1. pp. 67-125.

Curran, C. H.

1927. Studies in African Tachinidae (Diptera). Bul. Ent. Res., Vol. 17, pt. 4, pp. 319-340.

Currie, G. A.

1928. Entomological Hints to Cotton Growers. Queensland Agric. Jl., Vol. 0 pt. 2, pp. 100-102.

Della Torre, C. G.

1892-8. Catalogus Hymenopterorum.

Flint, W. P.

1914. On the Capture of Living Insects by the Cornfield Ant. Jl. Econ. Ent., Concord, N. H., Vol, 7, pp, 476-478.

Fullaway, D. T.

1914. Tobacco Insects in Hawaii. Hawaii Agric. Exp. Sta. Honolulu, Bul. 34, 20 pp., 9 figs.

Garman, H. and Jewett, H. H.

1914. The Life History and Habits of the Corn Earworm (**Heliothis obsoleta** Fabr.). Ky. Agric. Exp. Sta, Lex, Bul. 187, pp. 511-591.

Haines, G. C.

1927. (Natural Enemies and Control of Bollworms in South Africa). Proc. S. and E. Afr. Agric, Conf,, 1926, pp, 235-237.

Hine, J. S.

1919. Robberflies of the Genus Erax. Annals of Ent. Soc. of Amer., Vol. 12, pp. 103-154, 3 pl.

Husain, M. A.
1925. Annual Report of the Entomologist to the Government, Punjab, Lyallpur, for the year ending 30th June, 1924. Report Dept. Agric. Punjab, 1923-24, pt. 2, Vol. 1, pp. 50-90.

Jarvis, H.
1924. Fruit Fly Investigation. Queensland Agric. Jl., Vol. 21, pp. 382-385.

Kokujev, N.
1914. (Parasitic Hymenoptera New to the Fauna of Turkestan, Collected by V. I Plotnikov.) Revue d'Entomologie, St. Petersburg, 13, No. 3 and 4, pp. 513-514.

Leng, C. W.
1920. Catalogue of the Coleoptera of America, North of Mexico. The Cosmos Press, Cambridge, Mass., 470 pp.

Leonard, M. D.
1928. A List of the Insects of New York. Cornell University, Memoir 101, 1121 pp.

Luginbill, P.
1928 The Fall Army Worm. U. S. D. A. Tech, Bul, 34, 92 pp.

Mally, F. W.
1893. Report on the Boll Worm of Cotton (**H. armiger** Hubn.). U. S. D. A., Bur. of Ent, Bul, 29, Old series, 72 pp.

Marshall, G. E.
1930. Some Observations on **Orius** (Triphleps) **insidiousus** (Say). Jl. Kansas Entomological Society, Vol. 3, pp. 29-32.

McColloch, J. W. and Hayes, W. P.
1916. A Preliminary Report on the Life Economy of **Solenopsis molesta** Say. Jr. Econ. Ento., Vol. 9, pp. 23-28.

Muesebeck, C. F. W.
1920. A Revision of the North American Species of Ichneumon Flies Belonging to the genus Apanteles. Proc. U. S. Nat. Mus., Vol. 58, pp. 483-576.

Munro, H. K.
1926. ASouth African Mason Wasp as Insect Killer. Farming in So. Africa, Vol. 1, No. 2.

Phillips, W. J. and King, K. M.
1923. The Corn Earworm: Its Ravages on Field Corn and Suggestions for Control. U. S. D. A. Farmers' Bul, 1310, 17 pp.

Quaintance, A. L. and Brues, C. F.
1905. The Cotton Bollworm. U. S. D, A, Bur, of Ent., Bul, 50, 110 pp.

Riley, C. V.
1879. Parasites of the Cottonworm. Canadian Ent., Vol. 11, pp. 161-162.

Riley, C. V.
1885. Fourth Report of the United States Entomological Commission, 385 pp.

Rodionov, Z. S.
1927. Pests of Cotton, Part I. Defense des Plantes, Vol. 4, pp. 28-59.

Rosewall, O. W. and Smith, C. E.
1930. The Predatory Habits of **Cyrtopeltis varians.** Dist. Jl. Ec. Ent., Vol. 23, p. 464.

Shchegolev, V. N.
1929. The Lepidoptera of the Genus **Heliothis** as Insect Pests of Oil Plants and Medicinal Cultures, and Fodder Plants in the North Caucasian Region (In Russian) Byull. Sev. Kavkazek. Kraev sel.—khoz, opurtn Sta., No. 282, 48 pp., 16 fig., 30 ref.

Simmons, H. W.
1926. Report by the Acting Government Entomologists. Fiji Dept. Agric. Ann. Rept. 1925, pp. 7-9.

Vance, A. M.
1927. On the Biology of Some Ichenumonids of the Genus Paniscus, Schrk. Ann. Ent. Soc. Amer., Vol, 20, pp. 405-416.

Van Duzee, E. P.
1917. Catalogue of Hemiptera of America North of Mexico. Univ. of Calif. Publications, Vol. 2, pp. 1-14, 1-902.

Veitch, R.
1927. The Corn Earworm on Tomatoes. Queensland Agric. Jl., Vol. 28, pp. 585-588, 1 pl.

Vickery, R. A.
1929. Studies on the Fall Army Worm in the Gulf Coast District of Texas. U. S. D. A., Tech, Bul, 138, 64 pp.

Webber, R. F.
1930. A Revision of the North American Tachinid Flies of the Genus Achaetoneura. Proc. U. S. Nat. Museum, Vol, 78, pp. 1-37.

Wilkinson, D. S.

1929. New Parasitic Hymenoptera and Notes on Other Species. Bul. Ent. Res., Vol. 20, pp. 103-114, pl, 1,

Wilson, C. E.

192?. Insect Pests of Cotton in St. Croix and Means of Combating Them. Virgin Islands Agric. Expt. Sta. St. Croix, Bul. 3, 20 pp., 21 figs.

THE GIANT WALKING-STICK (MEGAPHASMA DENTRICUS (STAL.) FOUND IN KANSAS.

By

RAYMOND H. BEAMER, Lawrence, Kansas*

On November 9, 1931 Mr. W. U. Carter of Eudora, Kansas, brought a male specimen of **Megaphasma dentricus** (Stal.) to the Snow Entomological Collection for identification. He had collected this striking looking insect the day before near Garnett, Kansas. Being of an observing nature and recognizing that it was out of the ordinary, he brought it in alive to find out what it might be. This beautifully colored specimen of the "Giant Walking-stick" measures 125 mm. from its head to the tip of the cerci and is the first specimen of this species to be reported from the state. This same afternoon Mr. Carter accompanied the author to the locality. The season was past, however, and we found only the head and thorax of two females. Mr. Carter is to be congratulated on this find and the Snow Collection is enriched by its acquisition.

*Contribution from the Department of Entomology, University of Kansas.

THE GENUS ALAPUS (Homoptera, Cicadellidae).

By

PAUL B. LAWSON, Lawrence, Kansas.*

The Genus **Alapus** DeLong and Sleesman (1) was erected in 1929 for the species formerly known as **Deltocephalus fraternus** Ball and **Deltocephalus mendosus** Ball (2). The genus was described as follows:

"Vertex similar to **Flexamius** but more strongly produced, usually almost twice as long as width between eyes. Elytra with several cross veins in clavus and middle anteapical call usually divided into three or more cells. Male pygophers with flapper like structures attached to posterior margin inside of genital chamber and extending forward when in normal position."

Another characteristic of the genus is evident in the very greatly reduced hind wings which must be entirely useless as organs of flight.

A third species is here described and a key is given for the separation of the species.

Key to Species

1. Larger species, usually 3.5 mm. or over ..... 2.
   Smaller species, 3.25 mm. or less ..... **mendosus** Ball.
2. Male pygofer very long; female segment without sharp median teeth ..... **attenuatus** n. sp.
   Male pygofer normal; female segment with a pair of sharp median teeth ..... **fraternus** Ball.

Alapus attenuatus n. sp.

Closely related to **fraternus** but with vertex more acute and male pygofer much longer. Length, male 3.75 to 4 mm.; female 3.75 to 4.25 mm.

Head slightly wider than pronotum; vertex flat, one-half longer than width between the eyes, twice as long at middle as against the eye, apex quite acute. Pronotum half as long as vertex, over twice as wide as long, lateral margins quite short. Elytra as in **fraternus**, shorter than abdomen in female and much exceeded by elongated pygofer of male.

---

* Contribution from Department of Entomology, University of Kansas.

(1) Annals Ent. Soc. Amer., XXII, p. 86, 1929.

(2) Can. Ent., XLIII, p. 201, 1911.

Genitalia: Last ventral segment of female half longer than preceding; posterior margin concave and bearing narrow median slit bounded by indistinct teeth laterad of which are larger teeth and a definite notch, one or two small teeth between this notch and lateral angle, disc of segment black. Male valve large, triangular, one-third wider than long, apex acute; plates long and narrow, constricted opposite apex of valve, exceeding valve by about two-thirds its length, apices semiacute; pygofer very long, about twice as long as plates, blade-like appendages extending cephalad well under valve.

Color: Yellowish gray. Vertex with black semicircle enclosing light spot at apex, a trianglar spot caudad of this, four more or less rectangular spots on basal half, two or three reflexed arcs on each side, and median impressed line, dark brown. Pronotum with two irregular black spots on each side and suggestions of four light brown lines on disc. Scutellum with apex dark. Elytral veins strongly margined with fuscous, with two black spots on clavus and a much larger elongate black spot on disc. Lower part of face and middle of front pale brown; upper part and sides of front black with distinct light arcs. Rest of underside varyingly marked with brown.

Holotype, male, Loughman, Fla., Aug. 5, 1930, R. H. Beamer. **Allotype,** female, Ft. Myers, Fla., Aug, 14, 1930, Paul W. Oman. **Paratypes:** Two females, Ft. Myers, Fla., Aug. 14, 1930, Paul W. Oman; female, Ft. Myers, Fla., Aug. 11, 1930, J. Nottingham; two females, Ft. Myers and Venice, Fla., Aug. 11, 1930, L. D. Tuthill; male, Loughman, Fla., Aug. 3, 1930, L. D. Tuthill; two males, Yankeetown, Fla., July 3, 1930, R. H. Beamer.

All types deposited in Snow Entomological Collection.

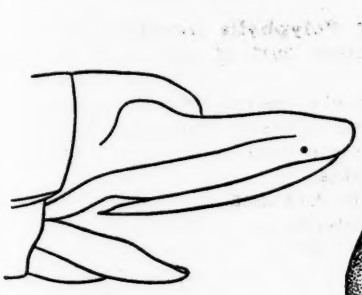
All three known species of this genus have so far been taken only in Florida. DeLong (3) states that **fraternus** and **mendosus** are not known to occur together, the former being more northern in its distribution. The writer has before him, however, a series of **fraternus** taken from Hilliard in the north, down

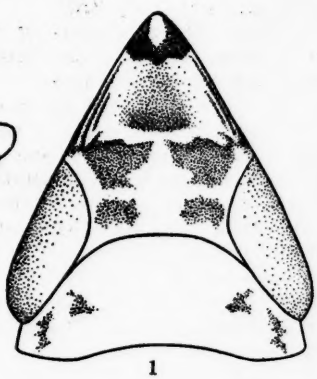
(3) Ohio State University Bulletin, II, p. 27, 1926.

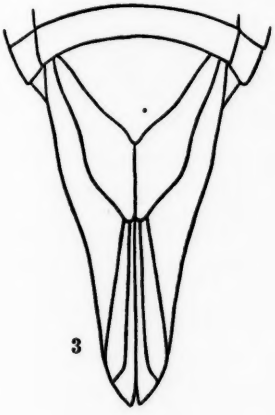
through Gainesville, Wildwood, Loughman, Plant City to Ft. Myers in the South. All three species of the genus are found at Ft. Myers, but only **fraternus** seems to be found outside of southern Florida.

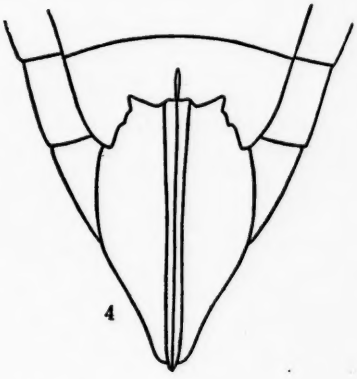
Explanation of Figures.

1. Head and pronotum, **Alapus attenuatus** n. sp.
2. Male genitalia, lateral view.
3. Male genitalia, ventral view.
4. Female genitalia.









SOME NOTES ON COLEOPTERA

By W. KNAUS, McPherson, Kansas

The season of 1931 in Central Kansas was hardly up to the average, due partly to lack of moisture in May and June, and extreme hot weather in July and August.

Sand dune collecting near Medora, Reno county in June and July, yielded, notably a single specimen of **Buprestis confluenta** Say, found on a dead Cottonwood tree. This is the only specimen of this species seen in this region in 45 years collecting.

One specimen of **Odentaeus filicornis** Say, was taken at light, July 3rd.

Some 20 specimens of **Polyphylla hammondi** Lec., were taken at light the latter part of June and early July, and all were males.

A correspondent in northwestern Arkansas, was fortunate in securing a nice series of **Lucanus elaphus** Fab., a rare species, the western limit of which reaches to Eastern Kansas and Oklahoma.

The prize capture of the Arkansas collector in July, was eleven specimens of **L. elaphus** on a Black Haw tree. Of the above specimens the writer was the recipient of six fine males, and five females, the latter being especially rare. One specimen received was a beautiful male of **elaphus, var. Carlengi** Angell. The locality being the extreme western record for this variety, known only from Northern Kentucky and Illinois.

The writer also received early in 1930 from a correspondent in Mexica, at Ruiz, some 250 miles south of Mazatlan some 30 specimens of a **Passalidae, Neleus tlascala** Perch. This species occurs rarely in Arizona.

FRANCIS HUNTINGTON SNOW

Dr. Francis Huntington Snow, whose likeness appears on our cover page, came to Kansas in August, 1866, and served the University of Kansas and the state for 42 years. Though he had prepared himself to teach Greek, the Natural Sciences were assigned to him when the University opened that fall. Entomology soon became his chief interest and throughout his professorship and chancellorship at the University, he became increasingly interested in collecting insects and in building up the collection which now bears his name. No one in the earlier days more strongly stimulated interest in Biology, particularly in Entomology, in this region.

CONTENTS OF THIS NUMBER

INSECT ENEMIES OF THE CORN EARWORM—T. F. WINBURN AND REGINALD H. PAINTER - - 1

THE GIANT WALKING STICK, FOUND IN KANSAS—RAYMOND H. BEAMER - - - 28

THE GENUS ALAPUS—PAUL B. LAWSON - - - 29

SOME NOTES ON COLEOPTERA—W. KNAUS - - 32

FRANCIS HUNTINGTON SNOW - - - 32

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

Publication Office, 119 South Main Street, McPherson, Kansas, W (arren) Knaus, Publisher

A quarterly journal published in January, April, July and October, devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

Subscriptions should be sent to the office of Publication, 119 South Main Street, McPherson, Kansas.

KANSAS ENTOMOLOGICAL SOCIETY

President R. H. Beamer, University of Kansas, Lawrence.
Vice President P. M. Gilmer, Wichita.
Sec.-Treas. R. L. Parker, Kansas State College, Manhattan.

Subscription, $1.00 per year **Single copy, 40 cents**

Volume V, No. 1, January, 1932. **Mailed January 7, 1932.**